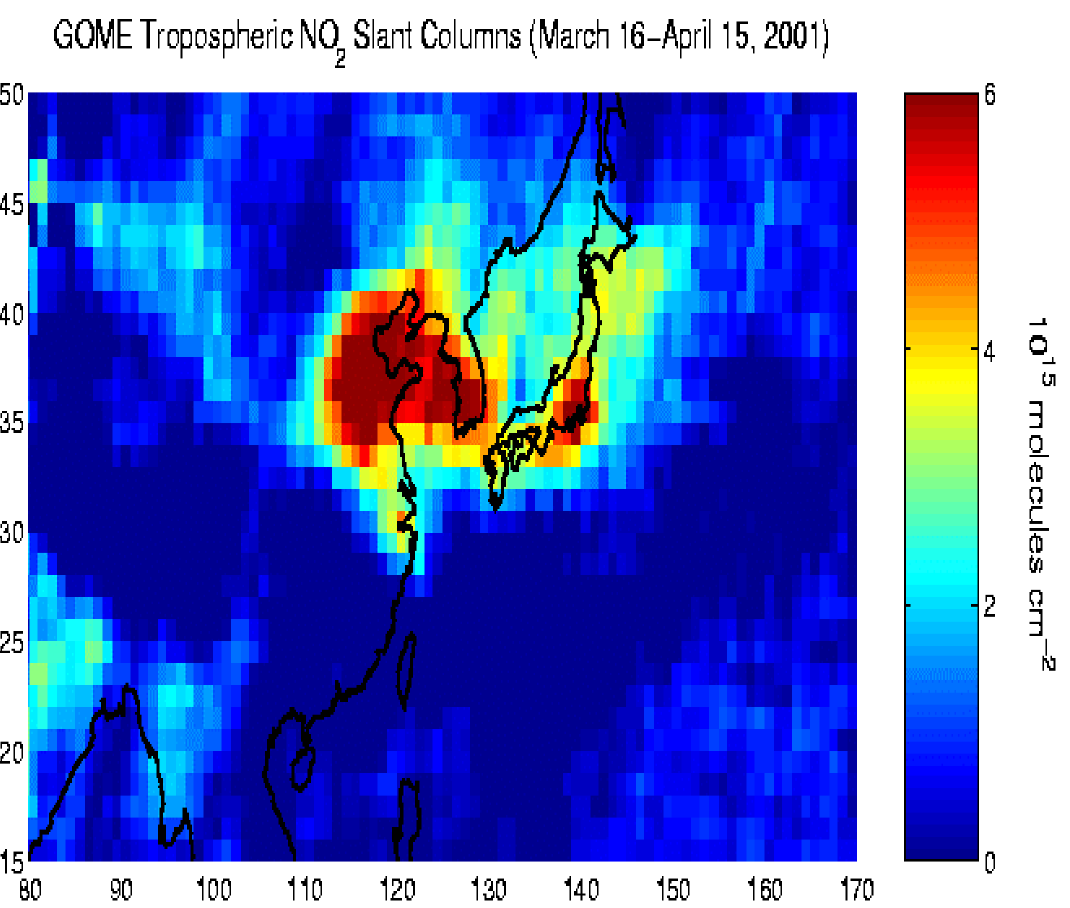
HARVARD GROUP TRACE-P ACTIVITIES
(⇨ planned papers)

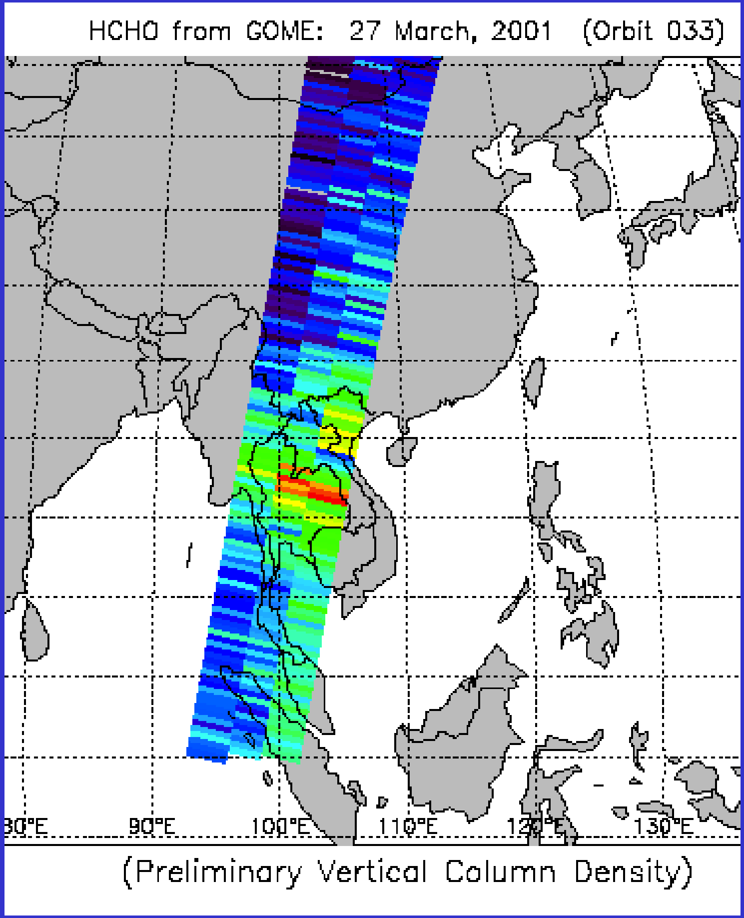
- **Bey**: Successes and limitations of chemical tracer forecasts
- **Evans**: global 3-D modeling of ozone, nitrogen, and HOx photochemistry
- **Fairlie**: Sources of carbonyls
- **Heald**: Biomass burning influences. TRACE-P/MOPITT integration
- **Jacob**: Design and execution of TRACE-P (overview paper)
- **Li**: Global budget of HCN
- **Mari/Saut**: Mesoscale modeling/convective processing during TRACE-P
- **Martin, Kurosu/Chance**: GOME observations of NO_2 and HCHO
- **Liu**: Transport pathways for Asian outflow: interannual variability
- **Palmer**: Quantifying Asian CO emissions by an inverse method
- **Suntharalingham**: CO_2 sources and sinks in Asia
- **Xiao**: Asian sources of methane and ethane

GOME daily data for NO_2 and HCHO tropospheric columns during TRACE-P (3/15 -)

Randall Martin

Thomas Kurosu/Kelly Chance





Mean slant NO_2 column, 3/16-4/15

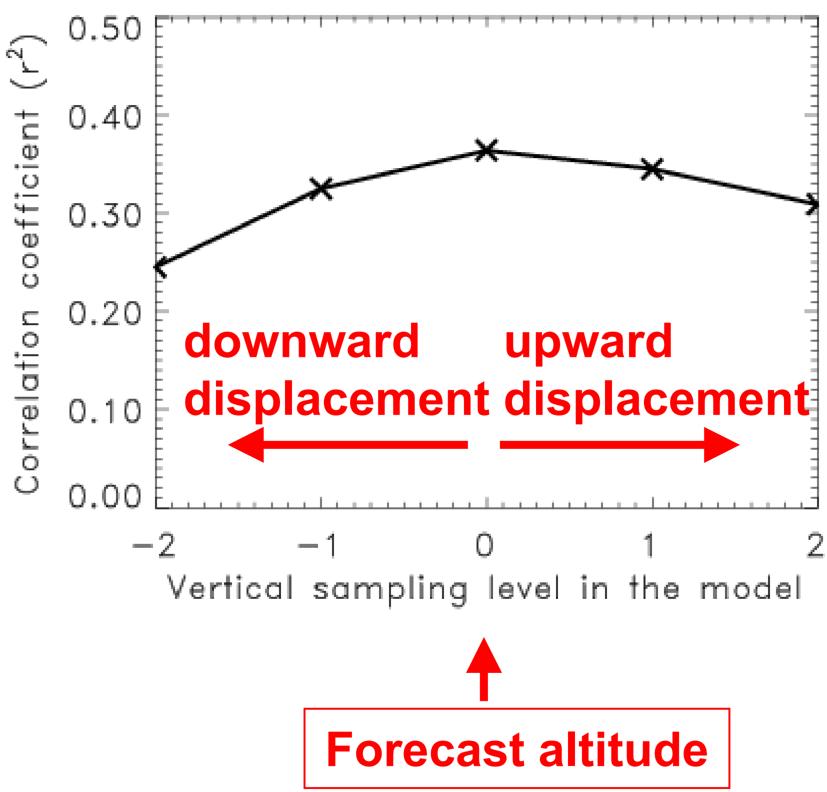
Slant HCHO column, single orbit on 3/27

Isabelle Bey et al.:
Errors in global chemical tracer forecasts

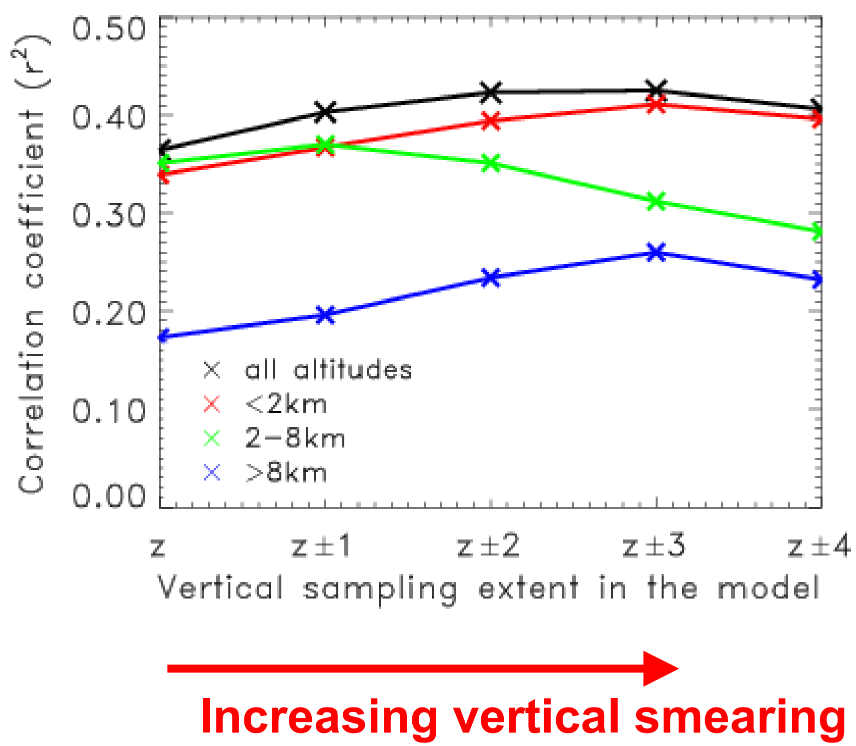
How reliable were the GEOS-CHEM forecasts for CO in TRACE-P? What errors should be applied in the interpretation of such forecasts?

Examine r^2 statistics for forecasts vs. observations

DISPLACEMENT ERROR

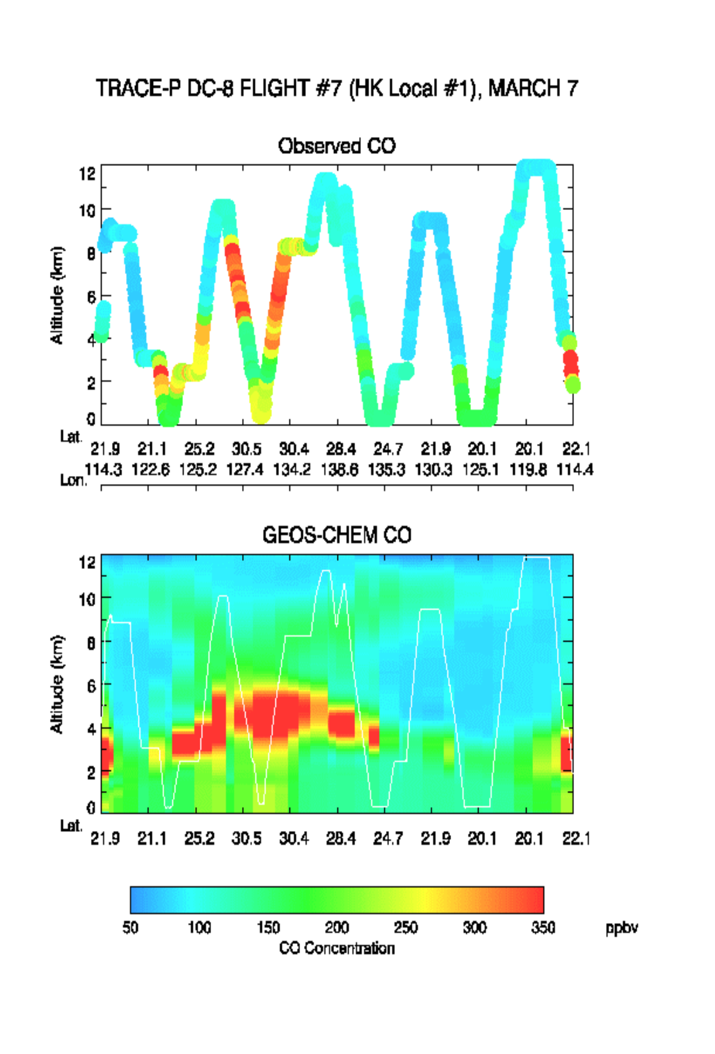


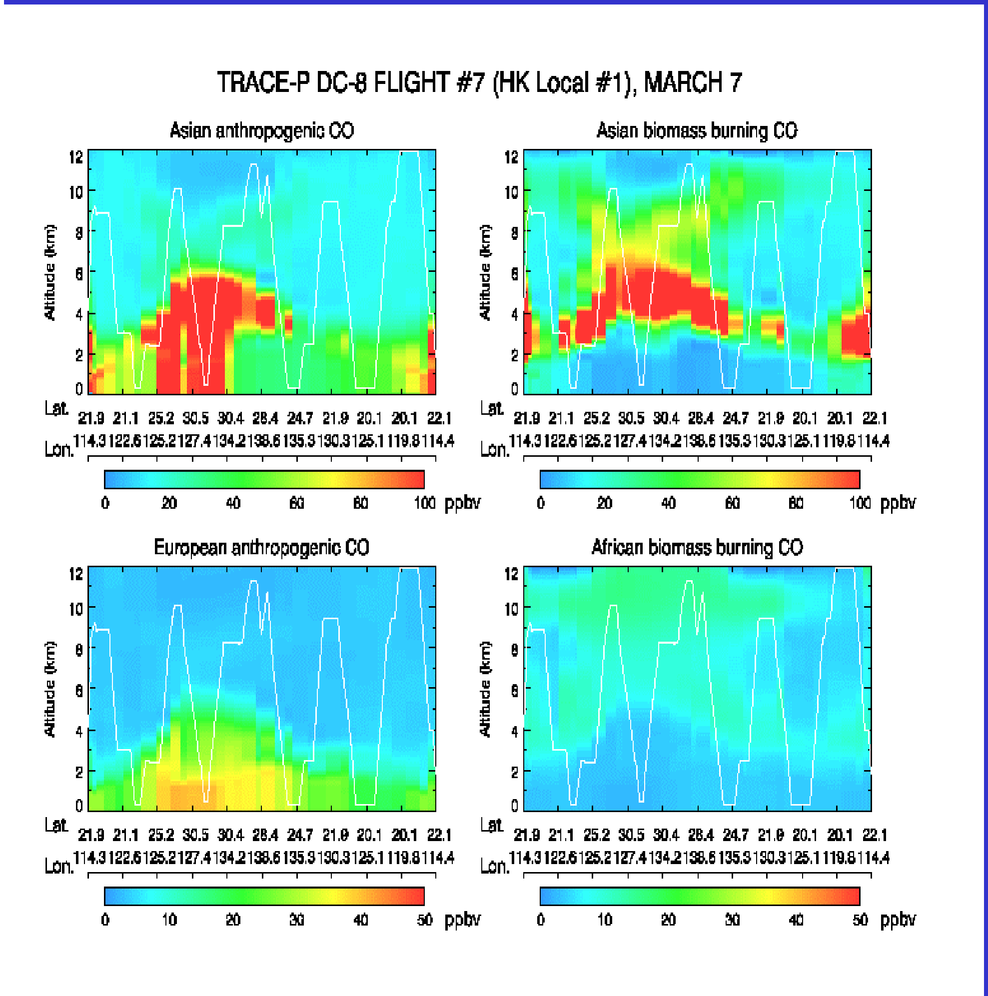
SMEARING ERROR



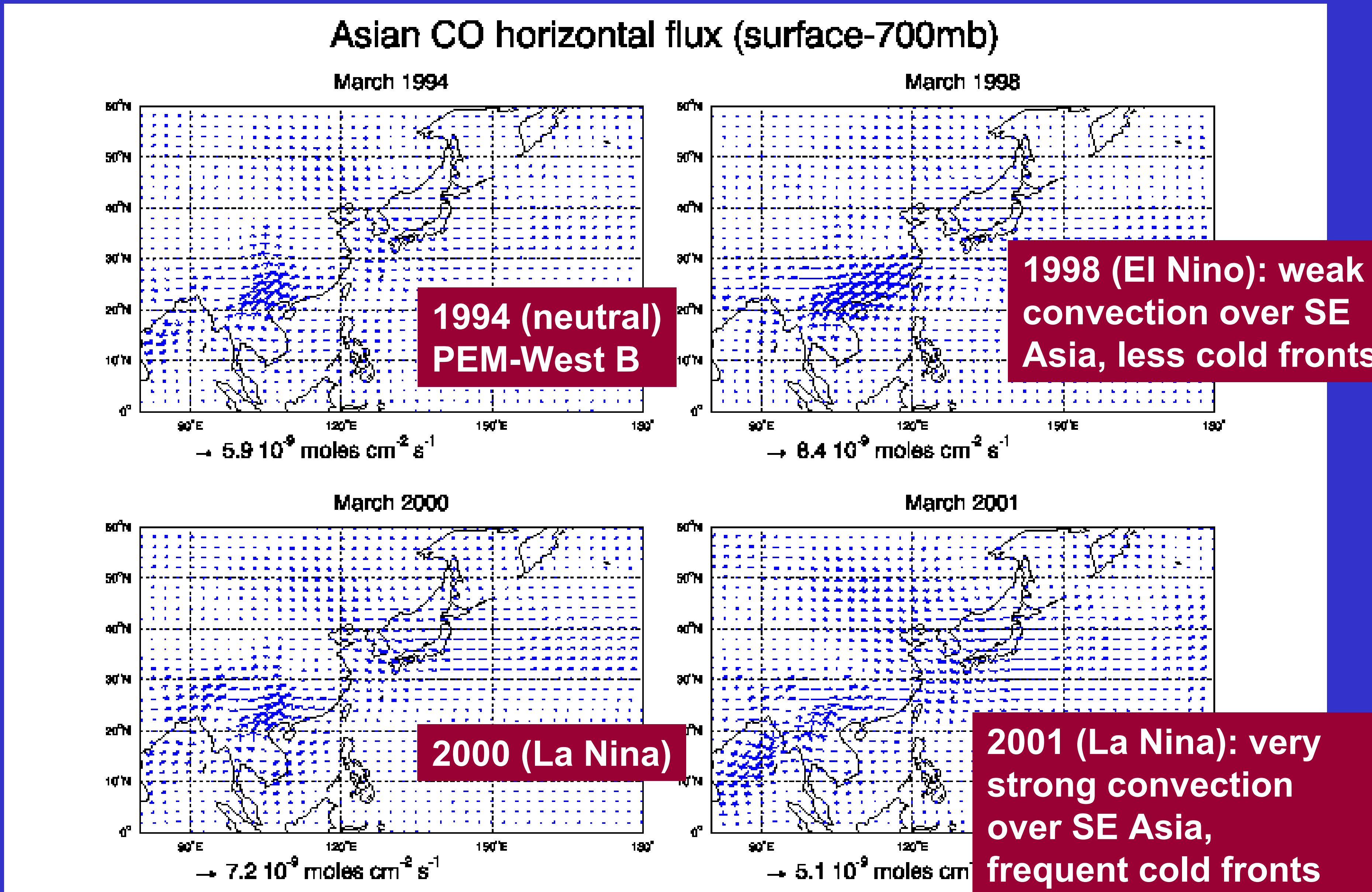
Hongyu Liuet al.
Pathways for Asian outflow to Pacific: interannual variability

Use GEOS-CHEM simulation of tagged CO tracers for 1994,1998,2000,2001 to determine major outflow pathways for different sources, interannual variability



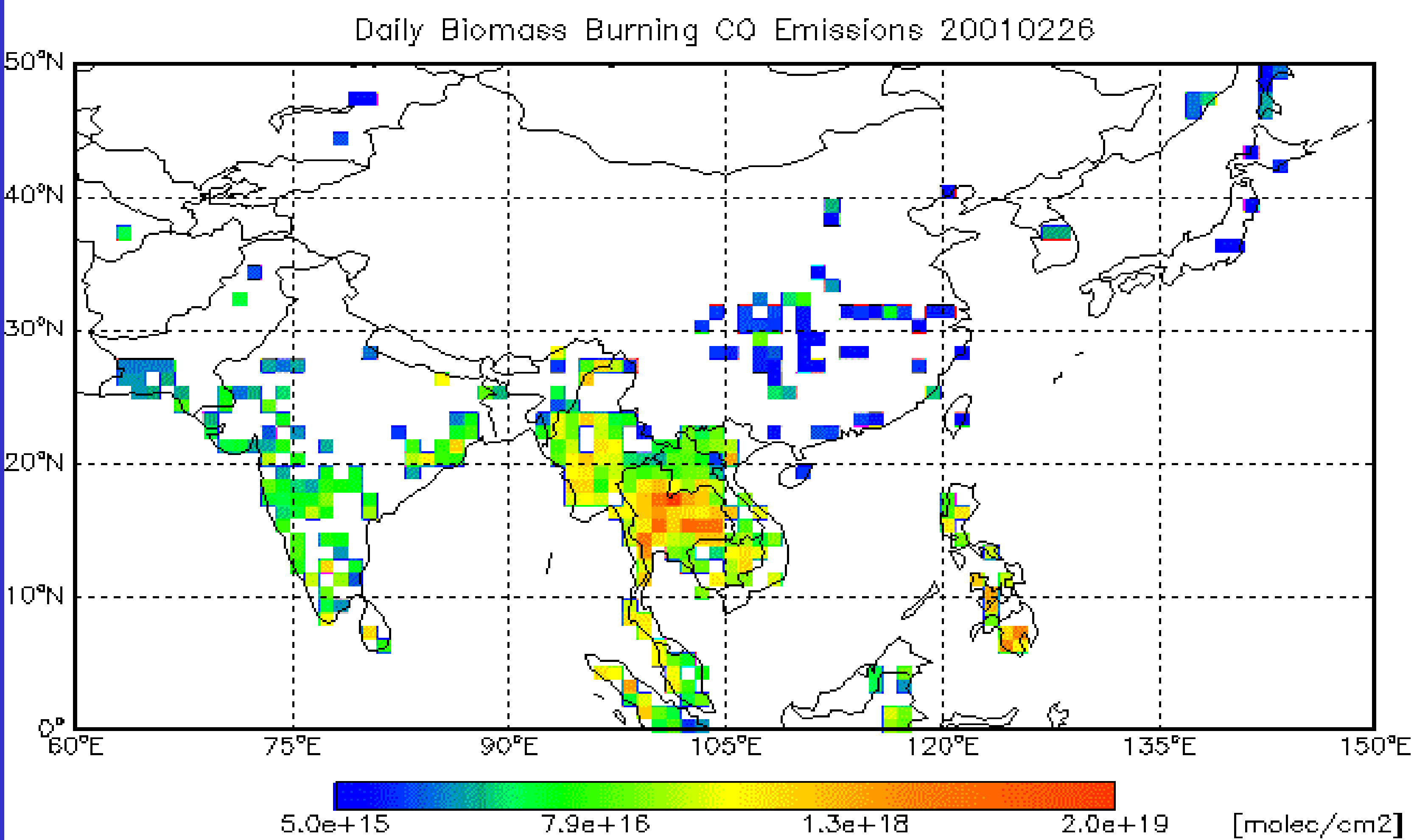


Hongyu Liu et al.
Pathways for Asian outflow to Pacific: interannual variability



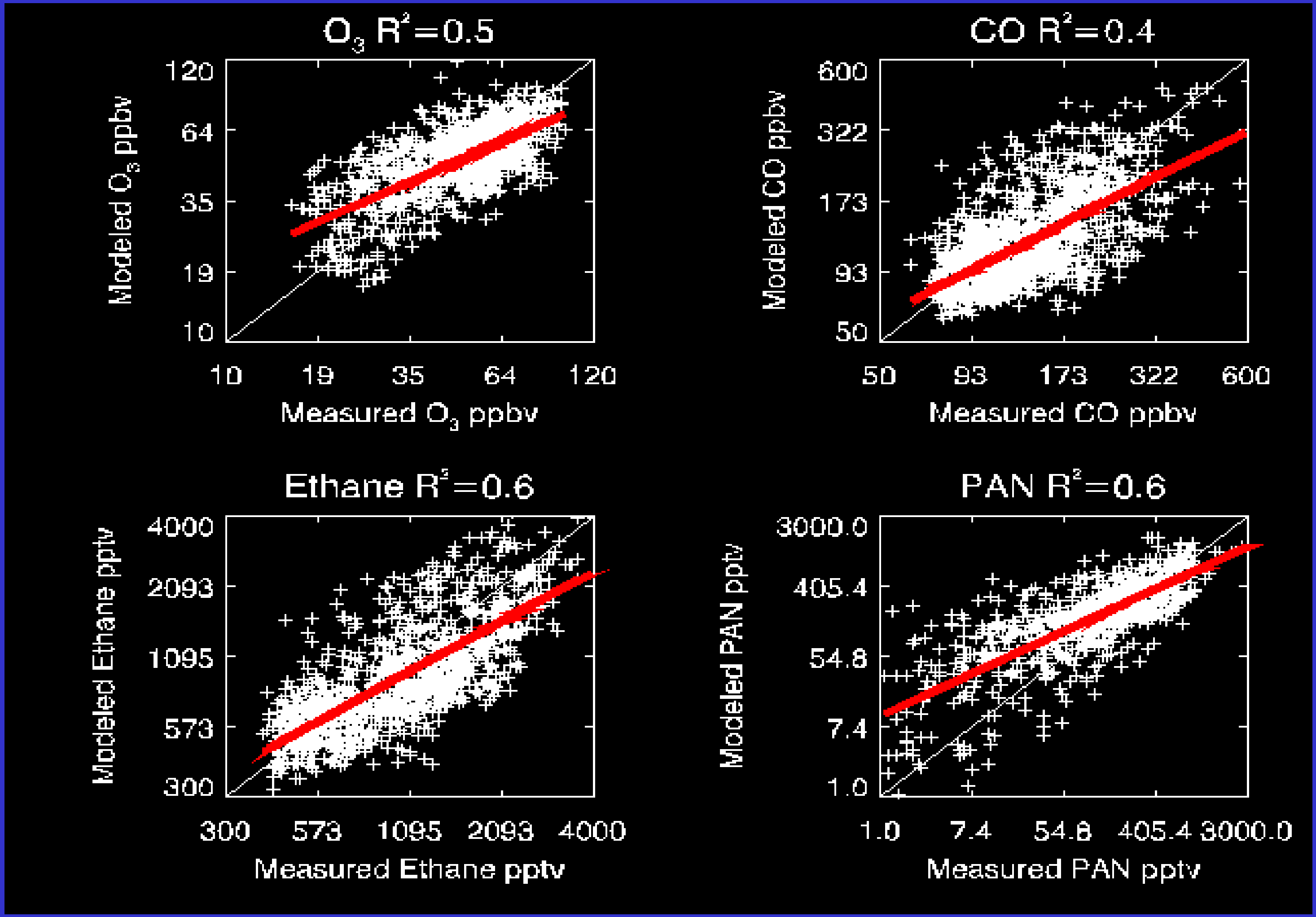
Colette Heald et al.: biomass burning influences, TRACE-P/MOPITT integration

Use daily AVHRR data to construct a daily-resolved global inventory of biomass burning emissions, apply to simulation of TRACE-P and MOPITT observations through the GEOS-CHEM model



Mat Evans et al.:
Global 3-D model analysis of ozone, NO_x, and HO_x

Global 3-D (GEOS-CHEM) simulation of ozone-NOx-CO-hydrocarbon chemisry for TRACE-P period; 80 species, 2°x2.5° resolution, 48 vertical levels



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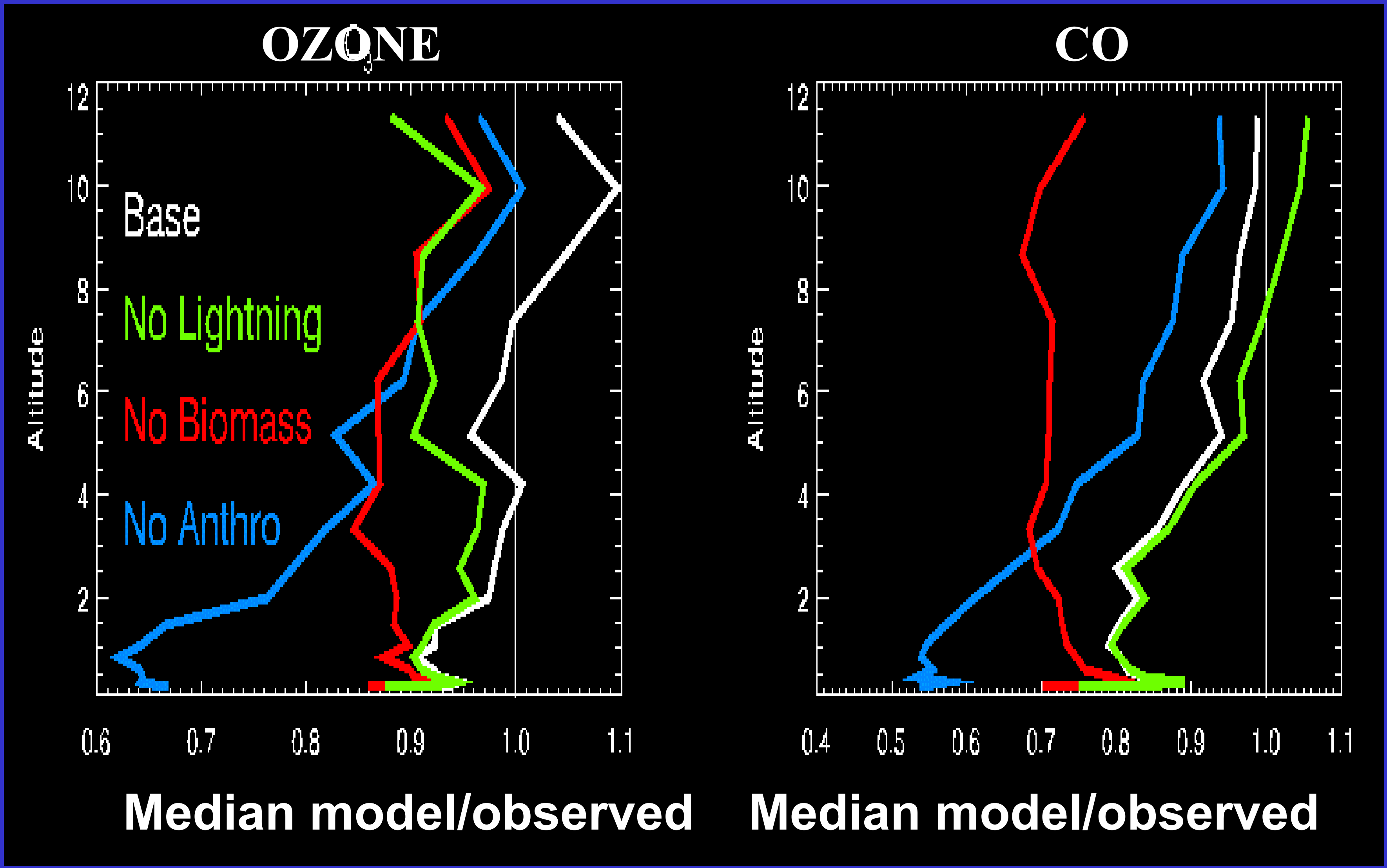
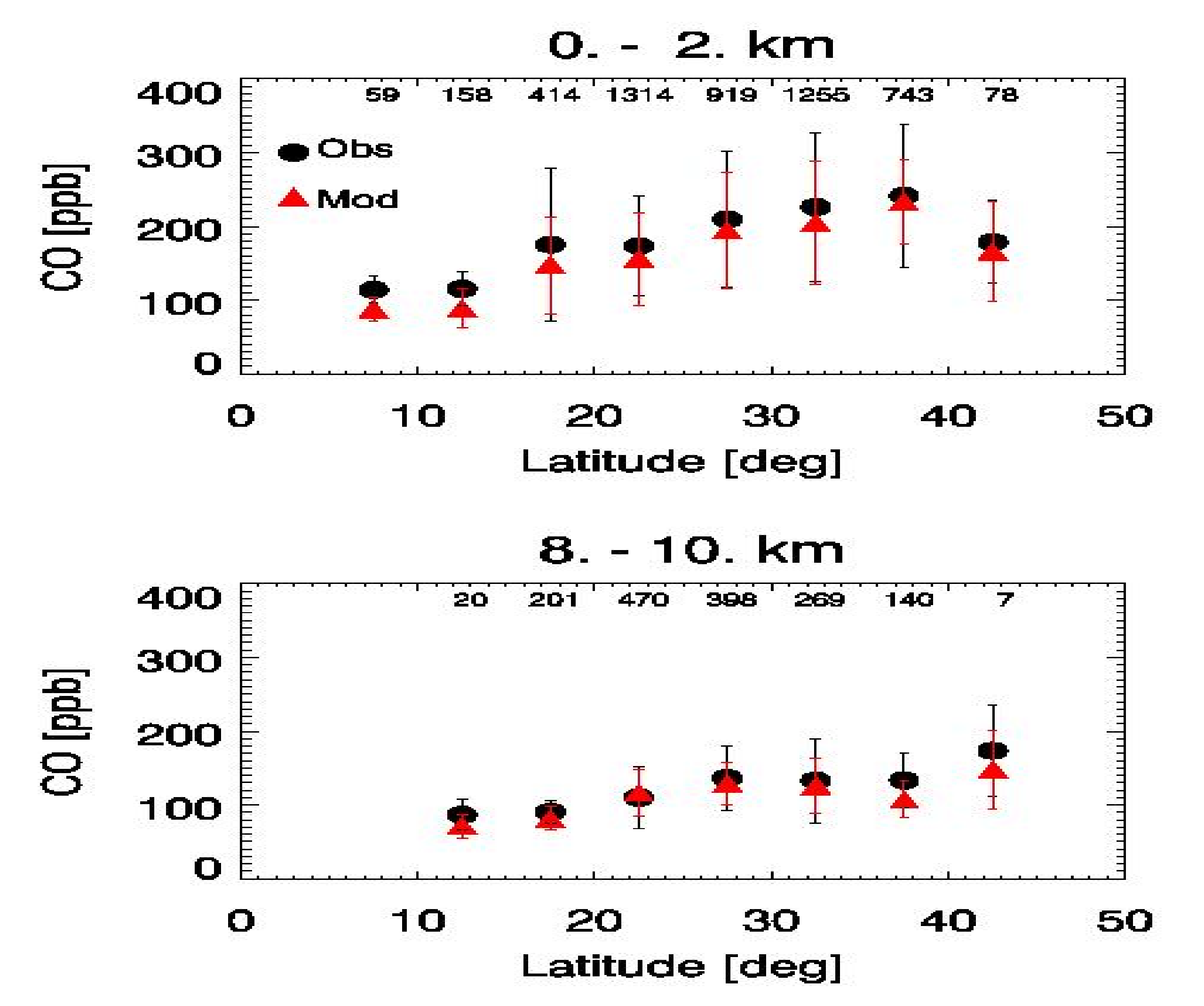


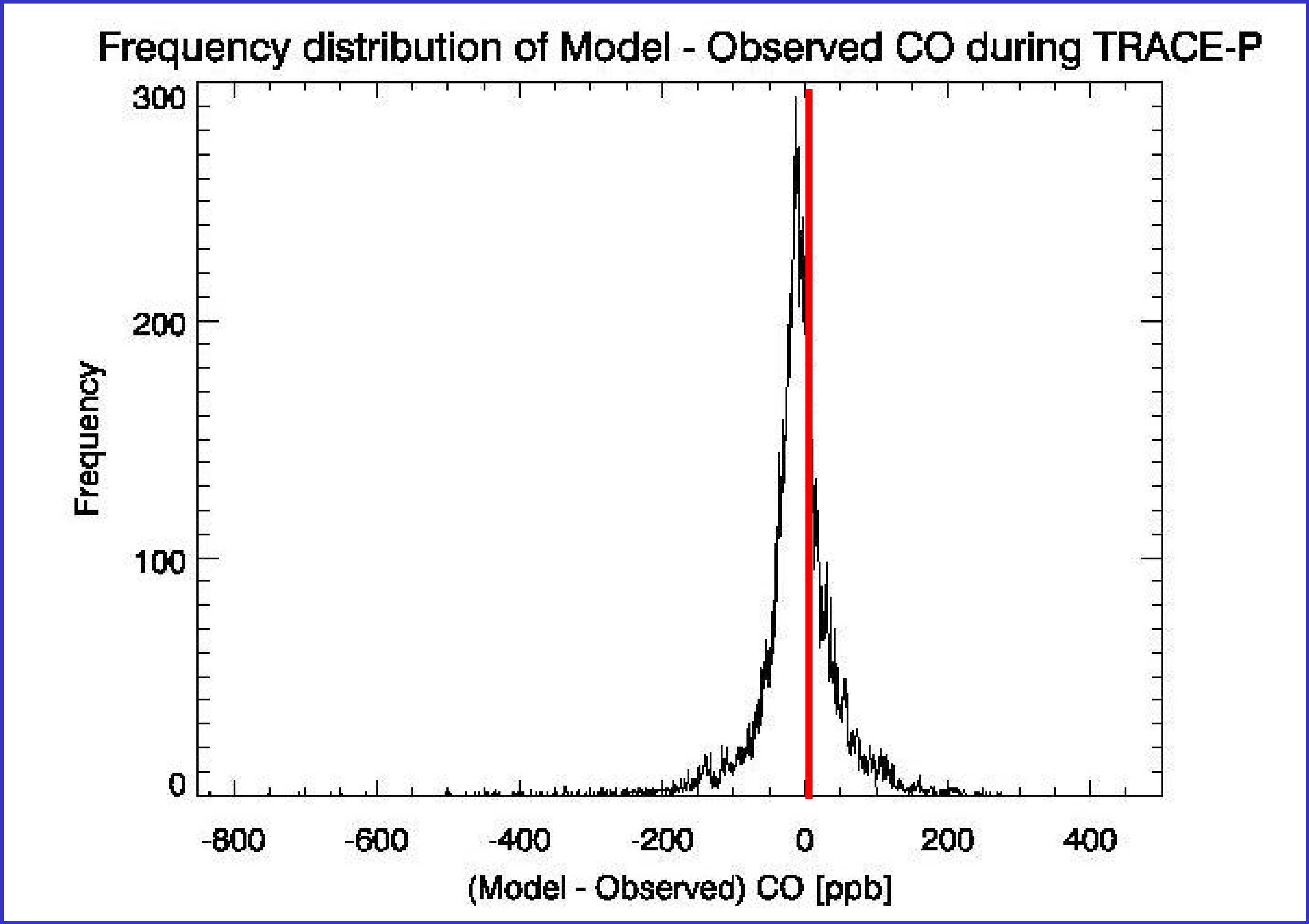
Paul Palmer et al.: Quantifying Asian CO emissions by an inverse method

Apply linear inversion analysis (11 source regions, anthro and bb) with a prioris from Logan and Streets (anthro) and Harvard (bb) and GEOS-CHEM as forward model

Ensemble of TRACE-P data

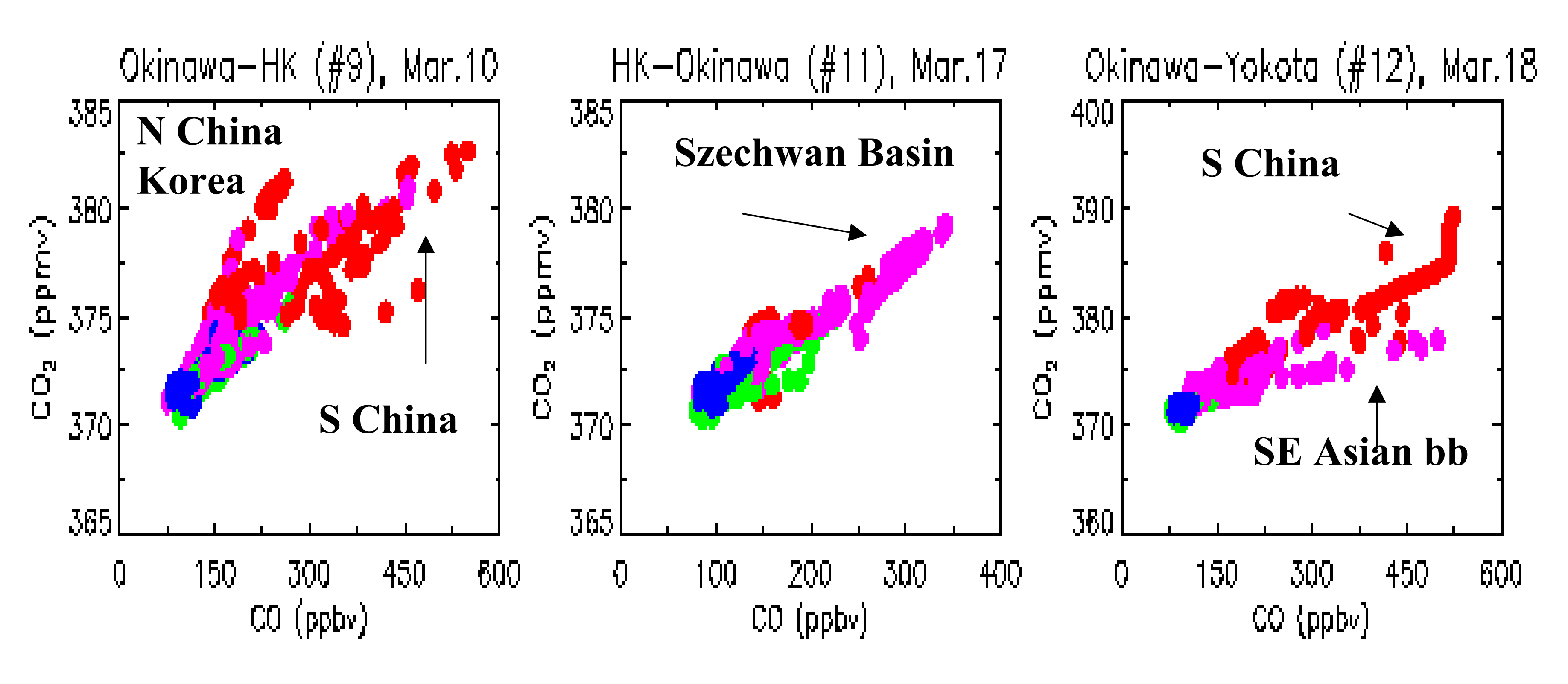


Paul Palmer et al.:
Quantifying Asian CO emissions by an inverse method



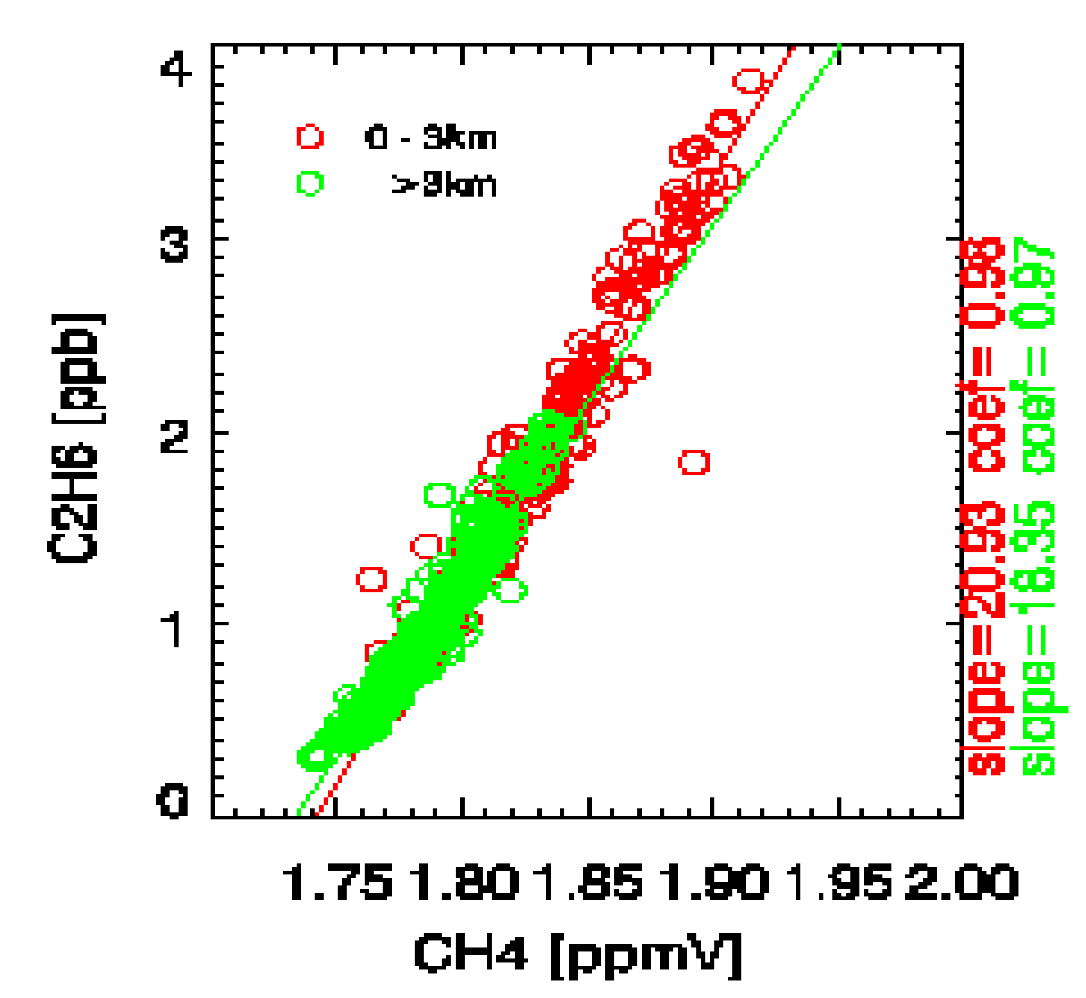
Parvadha Suntharalingham et al.: Inverse modeling of CO_2 sources/sinks from Asia

Apply a linear inverse model to the TRACE-P data using GEOS-CHEM as forward model and information from CO_2-CO-CH_4-C_2H_6 relationships



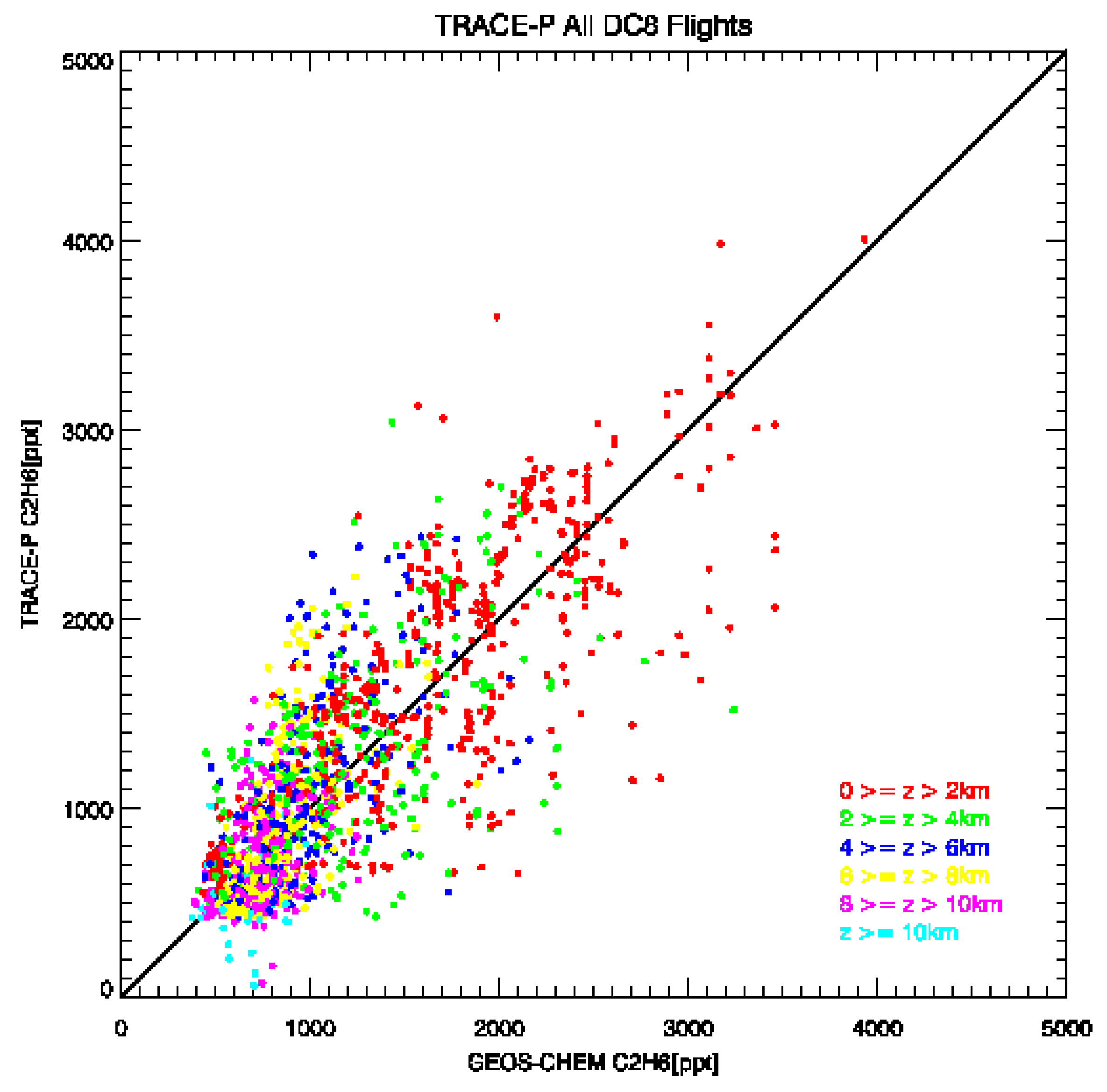
Yaping Xiao et al.:
Asian sources of methane and ethane

Improve estimates of methane and ethane sources in eastern Asia through simulations with GEOS-CHEM model and a priori information from Harvard and Streets emission inventories



C2H6 vs. CH4 relationship in ensemble of TRACE-P data

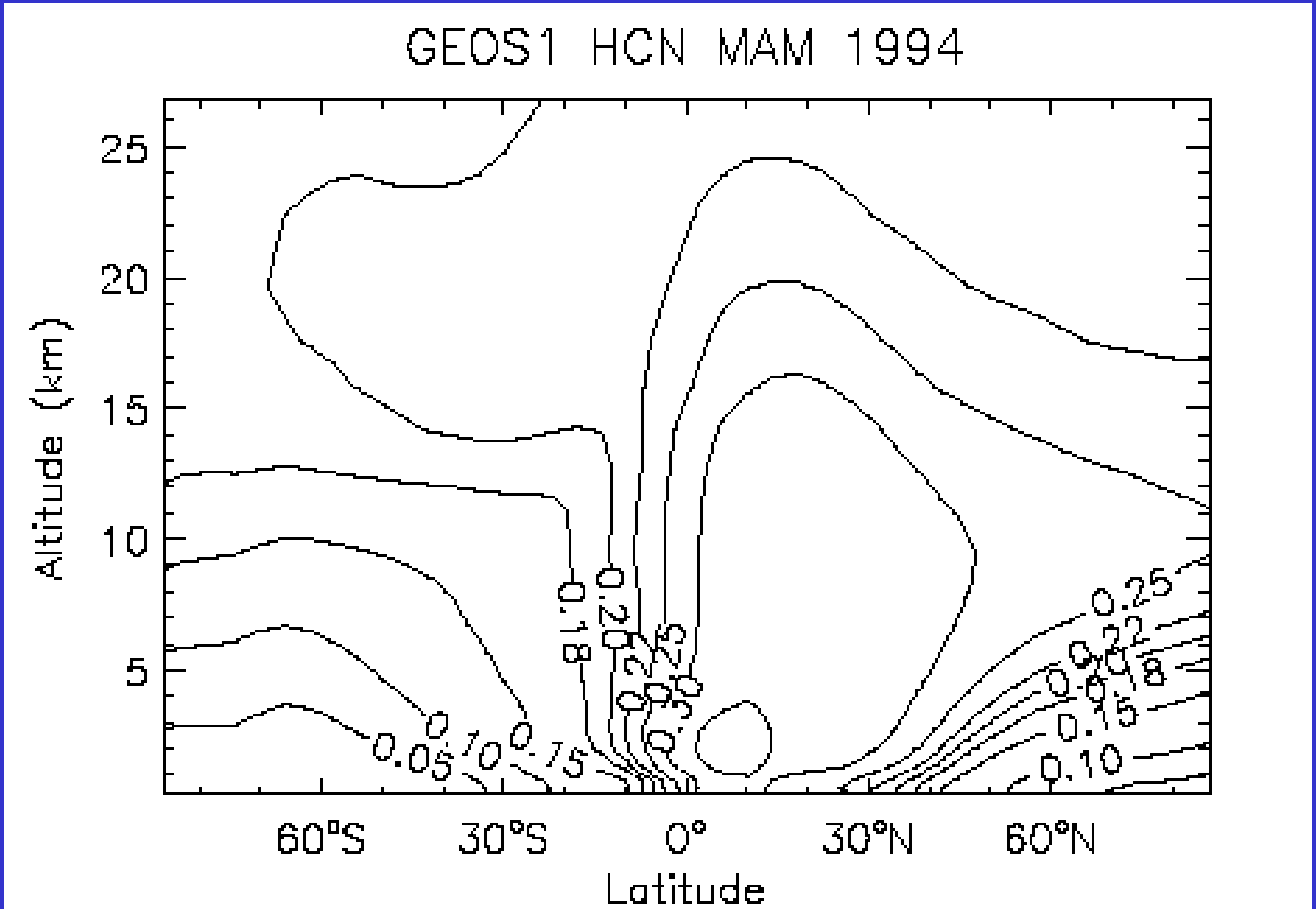
Yaping Xiao et al.:
Asian sources of methane and ethane



Model vs. observed Ethane (emissions from Streets)

Qinbin Li et al.:
Constraints from TRACE-P on global HCN budget

Simulate TRACE-P observations of HCN (Singh) with GEOS-CHEM model to evaluate hypothesis of Li et al. [GRL 2000] that atmospheric HCN is determined by biomass burning source and ocean sink



Global HCN model of Li et al. [2000]

Duncan Fairlie et al.:
Sources of acetone and acetaldehyde in TRACE-P

Apply GEOS-CHEM simulation to interpret concentrations, correlations in terms of sources and sinks: examine role of air-sea exchange

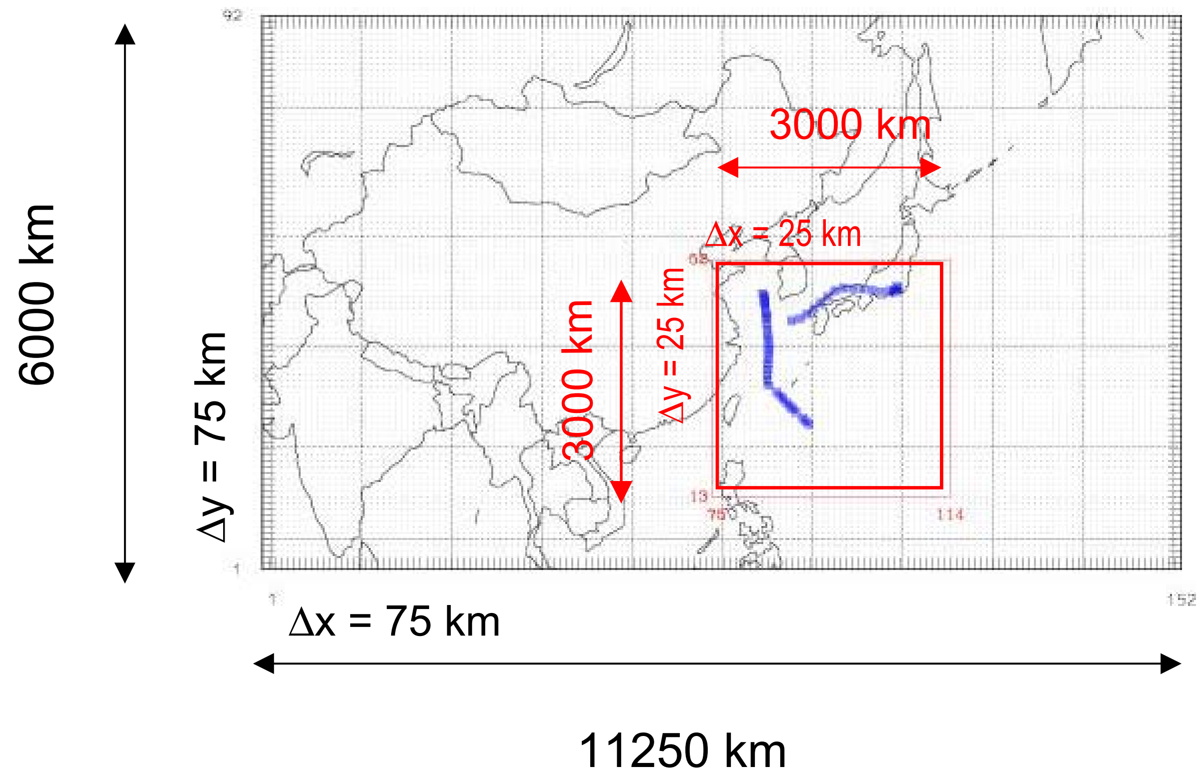
Focus on DC8 Flight 13 / Yokota Local 1: Frontal lifting and deep convection
C. Mari, C. Saüt and D. Jacob's band

Objectives:
(1) to characterize the lifting of Asian outflow by a cold front,
(2) to quantify the convective outflow from the SE Asia in the upper troposphere,
(3) to evaluate the stratosphere subsiding on the north side of the jet stream.

To achieve these goals...
(1) Use CTM GEOS-CHEM to get a picture of the chemistry & transport before and during the flight (aged biomass burning? european pollution? etc...)
(2) Use mesoscale modeling + nesting approach to simulate the episode at fine horizontal and vertical resolution (Δx=75km -> 25km -> 5km)
(3) Point-by-point comparison of mesoscale model results and observations
(4) Calculate pollution mass flux (CO, O3, NO, acetone, ...) from the boundary layer to the upper troposphere and across the Pacific Ocean

A Modeling Tool: the mesoscale model Méso-NHC
(http://www.aero.obs-mip.fr/mesonh/index2.html)

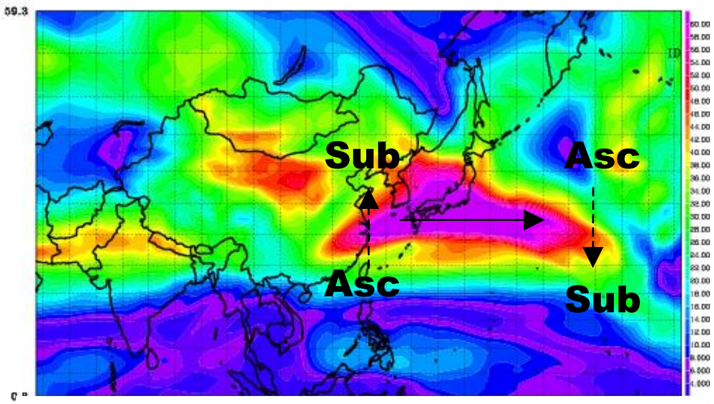
- 72 vertical levels from the surface to 43 mbar
- Vertical resolution: 50 m in the boundary layer, 400 m in the UT
- Emissions from GEIA + *Streets* for CO
- Timestep=50s
- Dynamical forcings from ECMWF every 6 hours



WIND SF

Meteorological features captured by the model

Jet stream at 330 K

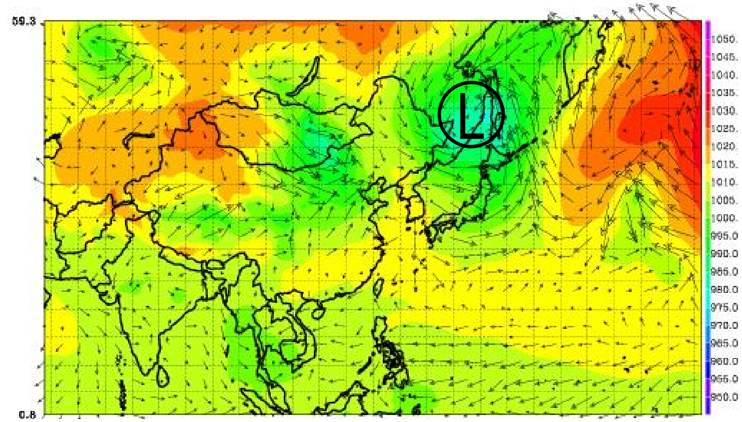


- Subtropical jet stream oriented just south of Japan

DATE MOD. 2001/ 3/19 0H 0M 0S DATE CUR. 2001/ 3/20 18H 0M 0S

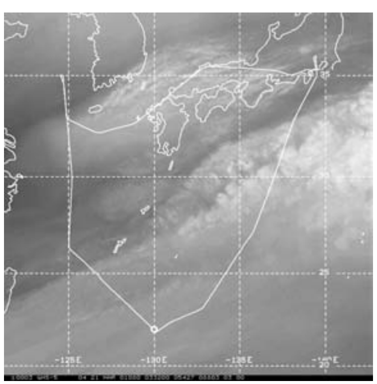
CNRS/LA/MNHC

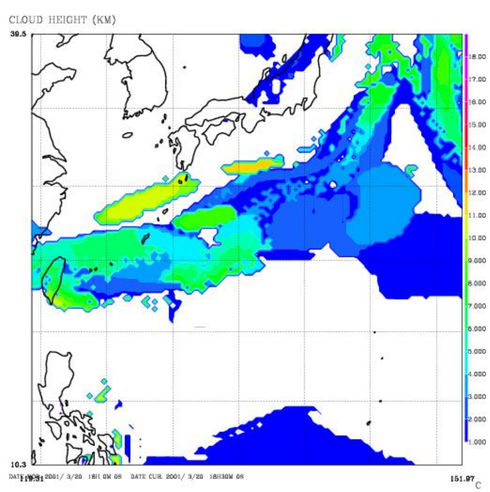
Mean Sea Level Pressure



- Surface low pressure centered over extreme northern Japan
- Cold front extended from it toward the southeast along 150E, then southwest toward Taiwan

Cloud cover

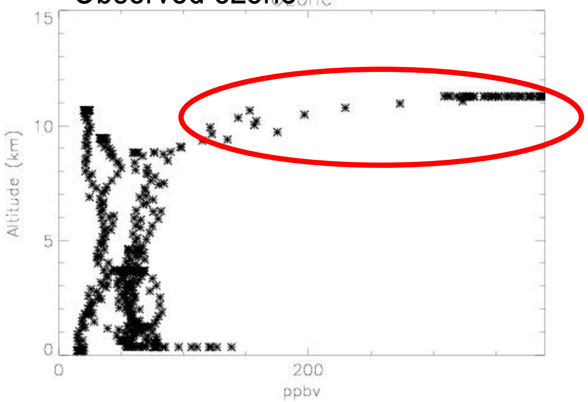




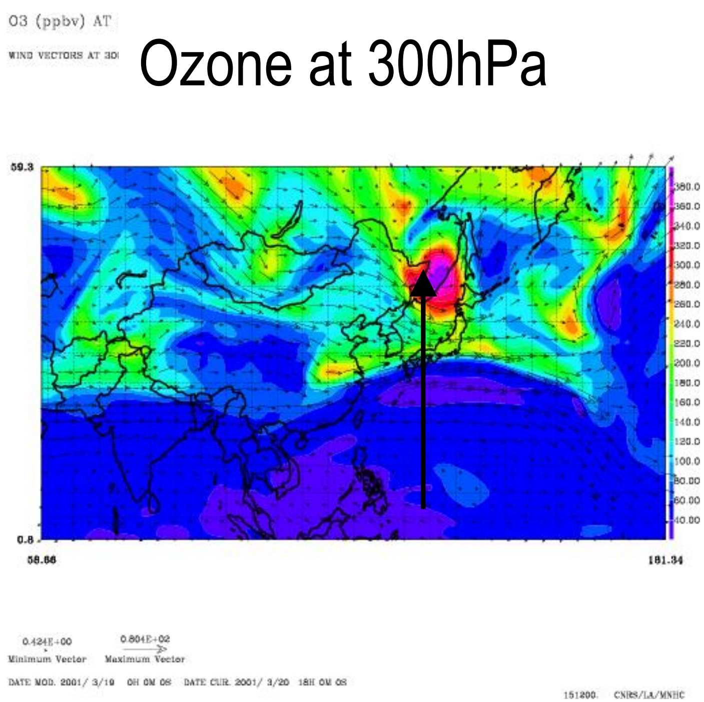
- Band of middle and upper clouds stretching from South of Tokyo to near Hong-Kong

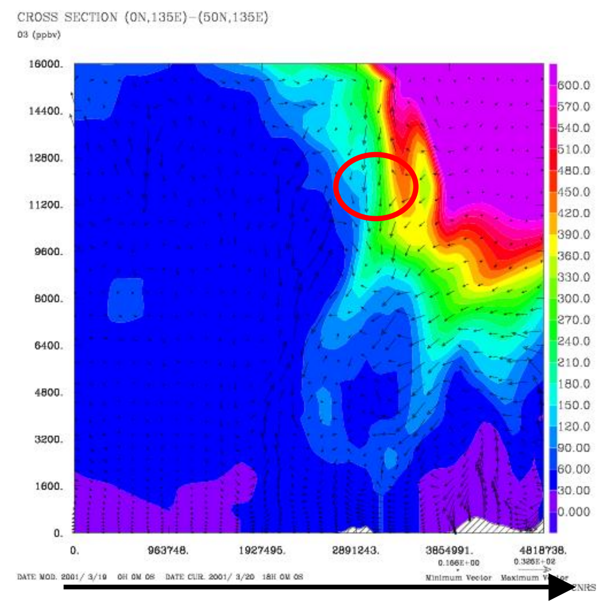
Ozone during flight 13:
Important feature: stratospheric ozone mixing ratios sampled on return flight to Yokota, north of the jet stream

Observed ozone



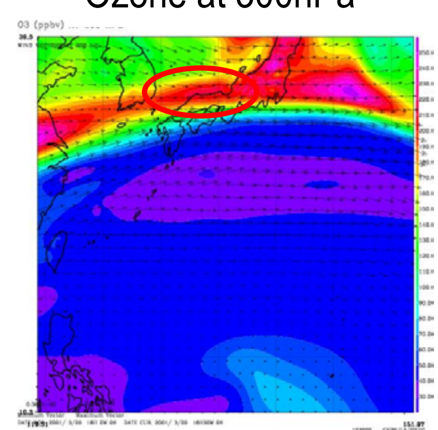
Ozone at 300hPa





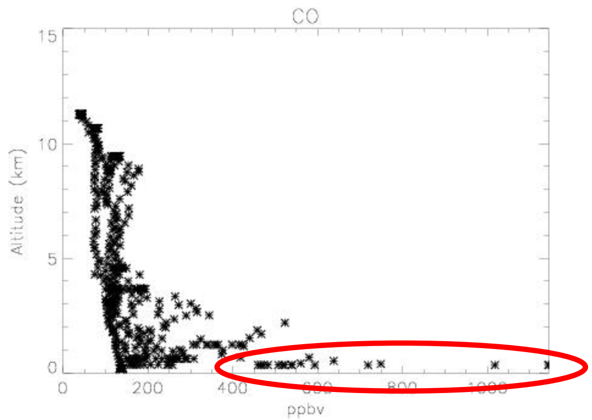
South-North cross section

Ozone at 300hPa

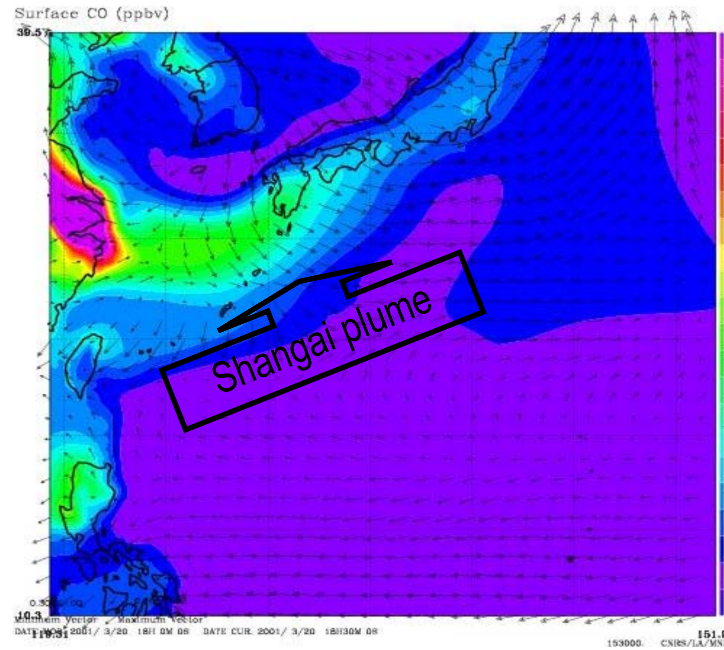


Nested model

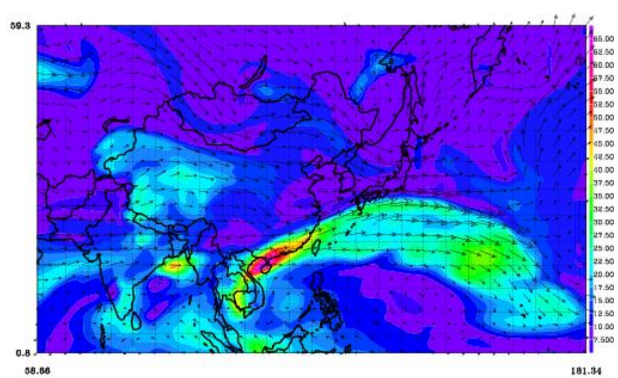
Surface CO: considerable Asian pollution sampled behind the front in the boundary layer (Shangaï plume)



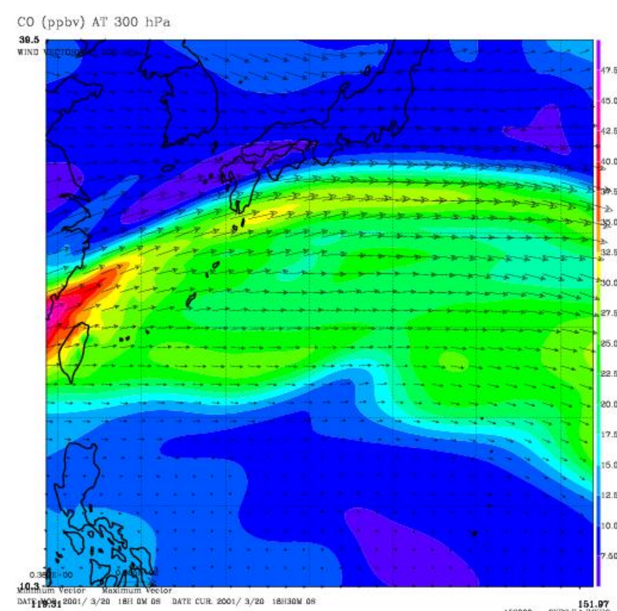
CO at the surface



CO at 300 hPa originated from upward transport south of Asia



CO at 300 hPa



Cross sections (12N,125E)->(38N,125E)